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## PATENT ABSTRACTS OF JAPAN

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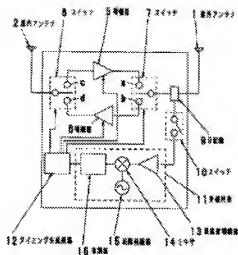
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(54) RADIO REPEATER

(57) Abstract:



PROBLEM TO BE SOLVED: To provide a radio repeater in which power consumption is reduced and no abnormal oscillation is caused.

SOLUTION: The radio repeater in which a signal for radio communication between a base station and a mobile station is amplified bidirectionally by amplifiers 5, 6 and the amplified signal is relayed, is provided with an antenna 1 installed outdoor for transmission reception with the base station, an antenna 2 installed indoor for transmission

reception with the mobile station, a reception circuit 11 to detect a signal via a control channel from the base station, and a timing generating circuit 12 generating a timing signal for slot synchronization with a timing of the signal via the control channel detected by the reception circuit 11. Then the power of the amplifiers 5, 6 is switched by the timing signal.

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CLAIMS

[Claim(s)]

[Claim 1] In a communication relay group which amplifies a signal of radio between a base station and a mobile station bidirectionally with an amplifier, and relayed it, An antenna for transmission and reception [ to the outdoors ] with a base station, and an antenna for performing transmission and reception with a mobile station indoors, Equip timing of a signal of a control channel detected in a receiving circuit which detects a signal of a control channel from a base station, and this receiving circuit with a timing generating circuit which generates a timing signal which carries out a slot synchronization, and with this timing signal. A communication relay group performing the enter end of a power supply of said amplifier.

[Claim 2] The communication relay group according to claim 1 adding a display for indication which displays a receiving level of a signal of a control channel which used an antenna of said outdoors as a directional antenna, and was detected by said receiving circuit.

[Claim 3] The communication relay group according to claim 1 or 2 installing two or more antennas indoor [ said ] selectable, detecting a receiving level of a signal in an antenna indoor [ said ] in said receiving circuit, and switching said two or more antennas with this receiving level.

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the communication relay group which relays the radio signal between the base station in a mobile communications system, and a mobile station.

[0002]

[Description of the Prior Art] In recent years, a cellular phone like PHS (Personal Handy phone System) is spreading dramatically from the convenience. PHS comprises a base station installed in the outdoors, and a mobile station which human being carries, and can be used as a cellular phone which can carry out sending and receiving to a directly public network.

[0003] In PHS, communication of a TDMA (Time Division Multiple Access)-TDD (Time Division Duplex) system is performed. In this communication method, a transmission slot differs from a receiving slot in time, and it communicates by switching transmission and reception. In PHS, since the frequency currently used is 1.9 GHz bands and is high frequency as semi-microwave, the electric wave from the base station installed in the outdoors cannot reach easily in a building. Since a large amount of expense is needed, especially installing an indoor base station in each place in the building where the person of a large number which there is public responsibility and carry a mobile station exists has the needs that he wants the electric wave from said outdoor base station to arrive indoors. In order to satisfy these needs, it is necessary to form the communication relay group which relays the electric wave from each between an outdoor base station and an indoor mobile station.

[0004] The outdoor antenna 1 which drawing 4 is an outline block diagram of this communication relay group, and transmits and receives an electric wave with an outdoor base station, and the indoor antenna 2 which transmits and receives an electric wave with an indoor mobile station, It has the circulators 3 and 4, the amplifier 5 for

the upstreams from a mobile station to a base station, and the amplifier 6 for the going-down circuits from a base station to a mobile station.

[0005]

[Problem to be solved by the invention]However, since it is unknown when communication is performed between a base station and a mobile station if it is in the conventional communication relay group, it is necessary to always make the power supply of the amplifiers 5 and 6 one, and power consumption becomes large. Since the isolation characteristic of the circulators 3 and 4 was insufficient, a return will start mutually between the two amplifiers 5 and 6, and there was a problem that the amplifiers 5 and 6 will oscillate.

[0006]it makes and comes out of this invention in view of the above-mentioned point. It is in providing the communication relay group which reduces the purpose and does not cause an abnormal oscillation.

[0007]

[Means for solving problem]In the communication relay group which the invention according to claim 1 amplifies the signal of the radio between a base station and a mobile station bidirectionally with an amplifier, and was relayed, The antenna for transmission and reception [ to the outdoors ] with a base station, and the antenna for performing transmission and reception with a mobile station indoors, Equip the timing of the signal of the control channel detected in the receiving circuit which detects the signal of the control channel from a base station, and this receiving circuit with the timing generating circuit which generates the timing signal which carries out a slot synchronization, and with this timing signal. It was made to perform the enter end of the power supply of said amplifier.

[0008]The invention according to claim 2 uses the antenna of said outdoors as a directional antenna in the invention according to claim 1, and the display for indication which displays the receiving level of the signal of the control channel detected by said receiving circuit was added.

[0009]In the invention according to claim 1 or 2 the invention according to claim

3, Two or more antennas indoor [ said ] are installed selectable, the receiving level of the signal in an antenna indoor [ said ] is detected in said receiving circuit, and said two or more antennas were switched with this receiving level.

[0010]

[Mode for carrying out the invention]Hereafter, an example of an embodiment of the invention is explained based on Drawings. Drawing 1 is a block diagram showing the outline composition of the communication relay group in which an example of an embodiment of the invention is shown. The outdoor antenna 1 with which the communication relay group of this embodiment transmits and receives an electric wave with an outdoor base station, The indoor antenna 2 which transmits and receives an electric wave with an indoor mobile station, and the amplifier 5 for the upstreams from a mobile station to a base station, It has a signal and the distributor 9 which gets down and distributes the signal for circuits, the switch 10, and the receiving circuit 11 and the timing generating circuit 12 the switches 7 and 8 for switching connection of the amplifier 6 for circuits and the amplifiers 5 and 6 by getting down, and for the upstreams from a base station to a mobile station.

[0011]The receiving circuit 11 has the low noise amplifier 13, the mixer 14, the local oscillator 15, and the demodulator 16, The signal of the control channel from a base station inputted via the distributor 9 and the switch 10, It mixes by the oscillation signal and the mixer 14 from the local oscillator 15 which are oscillated on the frequency of the immobilization corresponding to the control channel from a base station, demodulated data is further generated by getting over with the demodulator 16, and it is a receiving circuit only for a control channel.

[0012]The timing generating circuits 12 are an upstream and a thing which gets down and generates a timing signal of a slot of a circuit based on demodulated data outputted from the receiving circuit 11.

[0013]One of a power supply of the amplifiers 5 and 6, OFF, and a change of the switches 7 and 8 are controlled by a timing signal generated in the timing generating circuit 12. That is, in the case of a signal of a going-down circuit from an outdoor base station to an indoor mobile station inputted from the outdoor antenna 1, the switch

7 is switched to the terminal b side, and are one [ a power supply of the amplifier 6 ] and the switch 8 is switched at the terminal d side. Therefore, it gets down from a base station and a signal of a circuit is sent out to a mobile station through the terminal b of the outdoor antenna 1 and the switch 7, the terminal d of the amplifier 6 and the switch 8, and the indoor antenna 2. A signal of an upstream from an indoor mobile station to an outdoor base station serves as a course contrary to an above-mentioned case, and is sent out to a base station through the terminal c of the indoor antenna 2 and the switch 8, the terminal a of the amplifier 5 and the switch 7, and the outdoor antenna 1.

[0014]As mentioned above, according to the communication relay group of this embodiment, restore to a signal of a control channel from a base station by a receiving circuit, generate a timing signal of a slot, and with this timing signal. While the one [ getting down with an upstream and / a power supply in the direction of the required amplifiers 5 and 6 ] according to a circuit, Since it was made to switch the switches 7 and 8, it becomes unnecessary one [ a power supply of both amplifiers 5 and 6 ] always, Since reduction of power consumption can be aimed at, and it gets down with an upstream and a flow of a signal of a circuit was switched with the switches 7 and 8, it becomes without it seeming that the amplifiers 5 and 6 cause an abnormal oscillation.

[0015]Drawing 2 is a block diagram showing outline composition of a communication relay group concerning other embodiments of this invention. In composition of a communication relay group shown by drawing 1, it has composition which added the receiving level display for indication 17 which displays a receiving level of a signal of a control channel from a base station while the directional antenna 1a is used for a communication relay group of this embodiment as an outdoor antenna. Since an outdoor base station and this communication relay group are installed in a fixed place and relative physical relationship does not change, a directive direction can be set up the optimal by adjusting the direction of the outdoor directional antenna 1a based on a display level of the receiving level display for indication 17.

[0016]Drawing 3 is a block diagram showing outline composition of a communication



relay group concerning an embodiment of further others of this invention. In composition of a communication relay group shown by drawing 2, have composition of having formed separately the change over switch 19 of the indoor antenna 18 and the indoor antennas 2 and 18 independently [ the indoor antenna 2 ], and with the receiving level display for indication 17. By monitoring a level of each slot of an upstream, and switching connection of the antennas 2 and 18 with the change over switch 19, if lower than a threshold which a level of a head part of each slot set up, If the antenna with a big receiving level is used, the antenna diversity effect can be given.

[0017]

[Effect of the Invention]As mentioned above, in the communication relay group which according to the invention according to claim 1 amplifies the signal of the radio between a base station and a mobile station bidirectionally with an amplifier, and relayed it, The antenna for transmission and reception [ to the outdoors ] with a base station, and the antenna for performing transmission and reception with a mobile station indoors, Equip the timing of the signal of the control channel detected in the receiving circuit which detects the signal of the control channel from a base station, and this receiving circuit with the timing generating circuit which generates the timing signal which carries out a slot synchronization, and with a timing signal. Since get down with the object for upstreams and it becomes unnecessary one [ the power supply of both amplifiers for circuits ] always, since it was made to perform the enter end of the power supply of an amplifier, and it gets down with an upstream and the flow of the signal of a circuit was switched with a switch, The communication relay group which reduces power consumption and does not cause an abnormal oscillation has been provided.

[0018]Since the display for indication which displays the receiving level of the signal of the control channel which used the outdoor antenna as the directional antenna and was detected by the receiving circuit in the invention according to claim 1 was added according to the invention according to claim 2, If the orientation of a directional antenna is adjusted according to the receiving level displayed on the display for indication, the communicating state between a base station and a mobile

station can be improved.

[0019] In [ according to the invention according to claim 3 ] the invention according to claim 1 or 2, Since two or more indoor antennas are installed selectable, the receiving level of the signal in an indoor antenna is detected in a receiving circuit and two or more antennas were switched with this receiving level, The diversity effect can be given to the antenna of an indoor type and the place which the electric wave by a multipass does not reach easily can be decreased.

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**DESCRIPTION OF DRAWINGS**

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[Brief Description of the Drawings]

[Drawing 1] It is an outline block diagram of the communication relay group concerning an example of an embodiment of the invention.

[Drawing 2] It is an outline block diagram of the communication relay group concerning an example of other embodiments of this invention.

[Drawing 3] It is an outline block diagram of the communication relay group concerning an example of the embodiment of further others of this invention.

[Drawing 4] It is an outline block diagram of the communication relay group concerning a conventional example.

[Explanations of letters or numerals]

- 1 Outdoor antenna
- 2 Indoor antenna
- 5 Amplifier
- 6 Amplifier
- 7 Switch
- 8 Switch
- 9 Distributor
- 10 Switch
- 11 Receiving circuit
- 12 Timing generating circuit
- 13 Low noise amplifier
- 14 Mixer
- 15 Local oscillator
- 16 Demodulator
- 17 Receiving level display for indication
- 18 Indoor antenna
- 19 Switch

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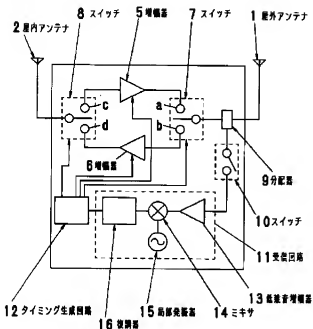
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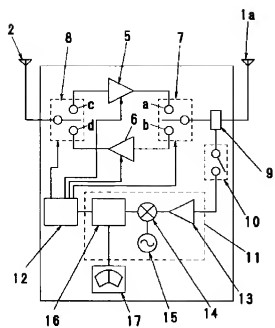
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## DRAWINGS

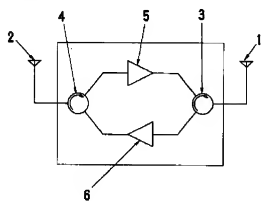
[Drawing 1]



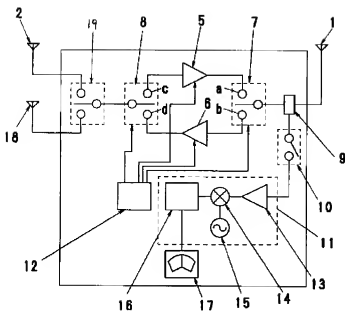
[Drawing 2]



[Drawing 4]



[Drawing 3]



[Translation done.]

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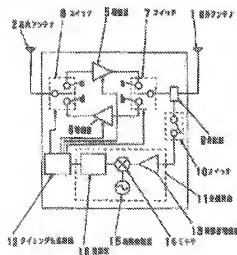
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## (54) RADIO REPEATER

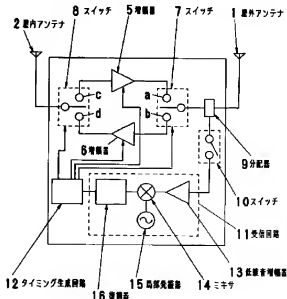
(57)Abstract:

**PROBLEM TO BE SOLVED:** To provide a radio repeater in which power consumption is reduced and no abnormal oscillation is caused.

**SOLUTION:** The radio repeater in which a signal for radio communication between a base station and a mobile station is amplified bidirectionally by amplifiers 5, 6 and the amplified signal is relayed, is provided with an antenna 1 installed outdoor for transmission reception with the base station, an antenna 2 installed indoor for transmission reception with the mobile station, a reception circuit 11 to detect a signal via a control channel from the base station, and a timing generating circuit 12 generating a timing signal for slot synchronization with a timing of the signal via the control channel detected by the reception circuit 11. Then the power of the amplifiers 5, 6 is switched by



the timing signal.





## 【特許請求の範囲】

【請求項1】 基地局と移動局間の無線通信の信号を増幅器により双方方向に増幅して中継するようにした無線中継装置において、屋外に基地局との送受信のためのアンテナと、屋内に移動局との送受信を行うためのアンテナと、基地局からの制御チャネルの信号を検知する受信回路及び該受信回路で検知された制御チャネルの信号のタイミングにスロット同期させるタイミング信号を生成するタイミング生成回路とを備え、該タイミング信号により、前記増幅器の電源の入り切りを行うようにしたことを特徴とする無線中継装置。

【請求項2】 前記屋外のアンテナを指向性アンテナとし、前記受信回路により検知された制御チャネルの信号の受信レベルを表示する表示器を付加するようにしたことを特徴とする請求項1記載の無線中継装置。

【請求項3】 前記屋内のアンテナを選択可能に複数設置し、前記受信回路では前記屋内のアンテナでの信号の受信レベルを検知し、該受信レベルにより前記複数のアンテナを切り換えるようにしたことを特徴とする請求項1または請求項2記載の無線中継装置。

## 【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、移動体通信システムにおける基地局と移動局間の無線信号の中継を行う無線中継装置に関するものである。

【0002】

【従来の技術】近年、その利便性からPHS(Personal Handy phoneSystem)のような携帯電話が非常に普及してきている。PHSは、屋外に設置される基地局と人間が携帯する移動局から構成され、直接公衆網に対して発信できる携帯電話として使用できる。

【0003】PHSでは、TDMA(Time Division Multiple Access)―TDD(Time Division Duplex)方式の通信が行われる。この通信方式においては、送信スロットと受信スロットとが時間的に異なり、送受信を切り換えて通信を行うようになっている。PHSでは使用している周波数が1.9GHz帯であり、準マイクロ波として高周波であるために、屋外に設置された基地局からの電波が建物内に到達しにくい。特に、公共性があれば移動局を携帯する多数の人が存在する建物内のそれぞれの場所に屋内基地局を設置するのは多額の費用を必要とするために、前記屋外基地局からの電波を屋内に届かせたというニーズがある。このニーズを満足させるためには、屋外基地局及び屋内移動局間に、各々からの電波を中継する無線中継装置を設けることが必要になる。

【0004】図4はこの無線中継装置の概略構成図であり、屋外の基地局との電波の送受信を行う屋外アンテナ1、屋内の移動局との電波の送受信を行う屋内アンテナ

2と、サーキュレータ3、4と移動局から基地局への上り回線用の増幅器5と、基地局から移動局への下り回線用の増幅器6とを有してなる。

【0005】

【発明が解決しようとする課題】ところが、従来の無線中継装置にあつては、基地局と移動局間でいつ通信が行われるかが不明であるために、増幅器5、6の電源を常時オンしておく必要があり、消費電力が大きくなる。また、サーキュレータ3、4のアイソレーション特性が不十分であるために、2つの増幅器5、6間で相互に帰還が妨かることになり、増幅器5、6が発振してしまうという問題があつた。

【0006】本発明は、上記の点に鑑みてなしたものであり、その目的とするところは、消費電力を低減させ、かつ、異常発振を起こすことのない無線中継装置を提供することにある。

【0007】

【課題を解決するための手段】請求項1記載の発明は、基地局と移動局間の無線通信の信号を増幅器により双方方向に増幅して中継するようにした無線中継装置において、屋外に基地局との送受信のためのアンテナと、屋内に移動局との送受信を行うためのアンテナと、基地局からの制御チャネルの信号を検知する受信回路及び該受信回路で検知された制御チャネルの信号のタイミングにスロット同期させるタイミング信号を生成するタイミング生成回路とを備え、該タイミング信号により、前記増幅器の電源の入り切りを行うようにしたことを特徴とするものである。

【0008】請求項2記載の発明は、請求項1記載の発明において、前記屋外のアンテナを指向性アンテナとし、前記受信回路により検知された制御チャネルの信号の受信レベルを表示する表示器を付加するようにしたことを特徴とするものである。

【0009】請求項3記載の発明は、請求項1または請求項2記載の発明において、前記屋内のアンテナを選択可能に複数設置し、前記受信回路では前記屋内のアンテナでの信号の受信レベルを検知し、該受信レベルにより前記複数のアンテナを切り換えるようにしたことを特徴とするものである。

【0010】

【発明の実施の形態】以下、本発明の実施の形態の一例を図面に基づき説明する。図1は、本発明の実施の形態の一例を示す無線中継装置の概略構成を示すブロック図である。本実施形態の無線中継装置は、屋外の基地局との電波の送受信を行う屋外アンテナ1と、屋内の移動局との電波の送受信を行う屋内アンテナ2と、移動局から基地局への上り回線用の増幅器5と、基地局から移動局へ下り回線用の増幅器6と、増幅器5、6の接続を切り換えるためのスイッチ7、8と、上り回線用の信号及び下り回線用の信号を分配する分配器9と、スイッチ1

0と、受信回路11及びタイミング生成回路12を有している。

【0011】受信回路11は、低雑音増幅器13、ミキサ14、局部発振器15、復調器16を有してなり、分配器9、スイッチ10を介して入力された基地局からの制御チャネルの信号を、基地局からの制御チャネルに対応する固定の周波数で発振する局部発振器15からの発振信号とミキサ14により混合し、さらに、復調器16で復調することにより復調データを生産するものであり、制御チャネル専用の受信回路である。

【0012】タイミング生成回路12は、受信回路11から出力される復調データに基づいて、上り回線及び下り回線のスロットのタイミング信号を生産するものである。

【0013】タイミング生成回路12で生成されたタイミング信号により増幅器5、6の電源のオン、オフ及び、スイッチ7、8の切り換えが制御されるのである。つまり、屋外アンテナ1から入力された屋外の基地局から屋内の移動局への下り回線の信号の場合には、スイッチ7は端子b側に切り換えられ、増幅器6の電源がオンされ、スイッチ8は端子d側に切り換えられる。従って、基地局からの下り回線の信号は屋外アンテナ1、スイッチ7の端子b、増幅器6、スイッチ8の端子d及び屋内アンテナ2を経て移動局に送出される。屋内の移動局から屋外の基地局への上り回線の信号は、上述の場合と逆の経路となり、屋内アンテナ2、スイッチ8の端子c、増幅器5、スイッチ7の端子a及び屋外アンテナ1を経て基地局に送出されるのである。

【0014】以上のように、本実施形態の無線中継装置によれば、基地局からの制御チャネルの信号を受信回路により復調して、スロットのタイミング信号を生成し、このタイミング信号により、上り回線と下り回線に応じて、必要な増幅器5、6の方の電源をオンするとともに、スイッチ7、8の切り換えを行うようにしたので、増幅器5、6の両方の電源を常時オンしておく必要がなくなり、消費電力の低減が図れ、また、上り回線と下り回線の信号の流れをスイッチ7、8により切り換えるようにしたので、増幅器5、6が異常発振を起こすようなこともなくなるのである。

【0015】図2は、本発明の他の実施形態に係る無線中継装置の概略構成を示すブロック図である。本実施形態の無線中継装置は、図1で示した無線中継装置の構成において、屋外アンテナとして指向性アンテナ1aを使用するとともに、基地局からの制御チャネルの信号の受信レベルを表示する受信レベル表示器17を付加した構成になっている。屋外の基地局及び本無線中継装置は固定した場所に設置されており、相対的な位置関係は変わらないので、受信レベル表示器17の表示レベルを基に、屋外の指向性アンテナ1aの方向を調節することにより、指向性の方向を最適に設定することができる。

【0016】図3は、本発明のさらに他の実施形態に係る無線中継装置の概略構成を示すブロック図である。図2で示した無線中継装置の構成において、屋内アンテナ2とは別に屋内アンテナ18及び屋内アンテナ2、18の切り換えスイッチ19を別途設けた構成になっており、受信レベル表示器17により、上り回線の各スロットのレベルをモニタし、各スロットの先端部のレベルが設定したきい値より低ければ切り換えスイッチ19によりアンテナ2、18の接続を切り換えることにより、受信レベルの大きなアンテナの方を使用するようにすれば、アンテナダイバーシチ効果を持たせることができるのである。

【0017】

【発明の効果】以上のように、請求項1記載の発明によれば、基地局と移動局間の無線通信の信号を増幅器により双方向に増幅して中継するようにした無線中継装置において、屋外に基地局との送受信のためのアンテナと、屋内に移動局との送受信を行うためのアンテナと、基地局からの制御チャネルの信号を検知する受信回路及び該受信回路で検知された制御チャネルの信号のタイミングにスロット同期させるタイミング信号を生成するタイミング生成回路とを備え、タイミング信号により、増幅器の電源の入り切りを行うようにしたので、上り回線用と下り回線用の増幅器の両方の電源を常時オンしておく必要がなくなり、また、上り回線と下り回線の信号の流れをスイッチにより切り換えるようにしたので、消費電力を低減させ、かつ、異常発振を起こすことのない無線中継装置が提供できた。

【0018】請求項2記載の発明によれば、請求項1記載の発明において、屋外のアンテナを指向性アンテナとし、受信回路により検知された制御チャネルの信号の受信レベルを表示する表示器を付加するようにしたので、表示器に表示された受信レベルに応じて指向性アンテナの指向方向を調整すれば、基地局と移動局との間の通信状態を良くすることができる。

【0019】請求項3記載の発明によれば、請求項1または請求項2記載の発明において、屋内のアンテナを選択可能な複数設置し、受信回路では屋内のアンテナでの信号の受信レベルを検知し、該受信レベルにより複数のアンテナを切り換えるようにしたので、屋内用のアンテナにダイバーシチ効果をもたらせることができ、マルチパスによる電波の届きにくいところを減少させることができる。

【図面の簡単な説明】

【図1】本発明の実施の形態の一例に係る無線中継装置の概略構成図である。

【図2】本発明の他の実施の形態の一例に係る無線中継装置の概略構成図である。

【図3】本発明のさらに他の実施の形態の一例に係る無線中継装置の概略構成図である。

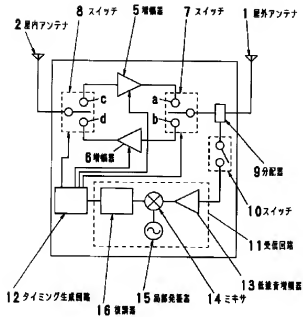
【図4】従来例に係る無線中継装置の概略構成図である。

【符号の説明】

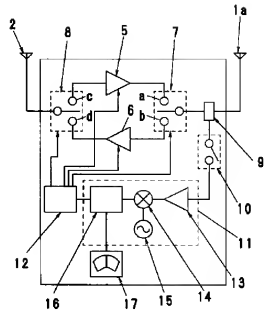
- 1 屋外アンテナ
- 2 屋内アンテナ
- 5 増幅器
- 6 増幅器
- 7 スイッチ
- 8 スイッチ
- 9 分配器
- 10 スイッチ
- 11 受信回路
- 12 タイミング生成回路
- 13 低雑音増幅器
- 14 ミキサ
- 15 局部発振器
- 16 復調器

- 10 スイッチ
- 11 受信回路
- 12 タイミング生成回路
- 13 低雑音増幅器
- 14 ミキサ
- 15 局部発振器
- 16 復調器
- 17 受信レベル表示器
- 18 屋内アンテナ
- 19 スイッチ

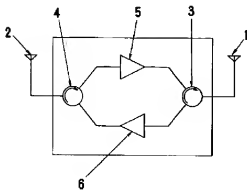
【図1】



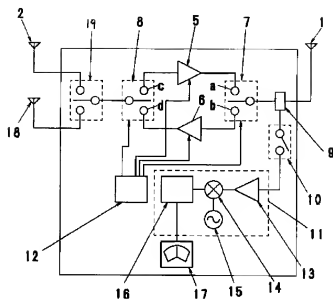
【図2】



【図4】



【図3】



フロントページの続き

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